

**Appendix I was submitted by Tom Suggs, Middle Tennessee Membership Corporation (MTEMC)**

## **APPENDIX I MIDDLE TENNESSEE ELECTRIC SYSTEM SYSTEM STUDY INFORMATION RELATED TO THE PROPOSED BINGHAM SUBSTATION**

Updated Information for Inclusion in the One Owner Study for Bingham Substation

### **INTRODUCTION**

Since the April 1999 “Input to a One Owner Study for Bingham Substation” document was provided to TVA, there have been some fairly significant system upgrades and also some very significant events from a development standpoint that have or will affect the ultimate numbers for the Bingham justification.

System upgrades:

- A new substation at Thompsons Station was brought on line in 2001. This station partially unloaded our Henpeck Station.
- A second power transformer was added at our Grassland Station.

These upgrades will affect any new economic analysis of the Bingham delivery point question. Included in this document is a discussion of how these projects will change the April 1999 study.

Development “Drivers”

- The proposed extension of Mack Hatcher Parkway into the Bingham Station service area was not considered in our original study.
- Sewer service extensions into the Bingham Station service area were not considered in our original study.
- Westhaven was not considered in our original study.

These factors will greatly drive the loading in the area projected to be served by the Bingham Station. New projected loading numbers are included later in this document.

Also included in this document are historical outage rates for the proposed Bingham Station service area, as well as projected outage rates for the area long term, both if the station is built and if it is not.

Circuit and substation loading numbers are also discussed in this document.

### **SYSTEM UPGRADES**

Both the Thompsons Station sub and the second transformer at Grassland were projects that were needed to meet existing loads on the MTEMC system. However, continued rapid load growth in the Henpeck and Grassland service areas will force MTEMC to further upgrade those stations in the future. The following chart shows the loading on the substations that serve the area to the west of Franklin:

Page intentionally blank

#### Aspen Grove - Westhaven 161-kV Transmission Line

| Substation  | 2001 Loading(MW) | Growth Rate | Year 70MW Reached |
|-------------|------------------|-------------|-------------------|
| Aspen Grove | 60               | 8%          | 2004              |
| Franklin    | 55               | 5%          | 2006              |
| Grassland   | 32               | 8%          | 2012              |
| Henpeck     | 56               | 8%          | 2004              |

The area served by these stations has been growing at about a 12% annual rate for the past few years. Lower rates were used in the above chart, but the rate could remain at its current level or even increase slightly.

70 megawatts is used as ultimate loading on these stations due to the fact that at slightly above 70 megawatts, on hot summer days, we have had thermal alarms activate.

There will likely be a transfer of load between Aspen Grove and Grassland Stations to help unload Aspen Grove, but the tie lines needed are not currently in place. The chart above assumes that this load transfer will not occur. If it does, and that appears to be likely, then the transfer will need to take place in 2004. The amount of load transferred will be approximately 10 MW. Thereafter, Aspen Grove will exceed 70 MW in 2006 and Grassland will exceed 70 MW in 2009. Additional load transfers from Aspen Grove will be needed in 2006. If Bingham is not built, there will be a third bank in service at Henpeck by this time. Approximately 15 MW can be shifted from Aspen Grove to Henpeck in 2006, then Aspen Grove will reach 70 MW again in approximately 2010.

Jingo Substation is not considered a viable source of increased power to the Bingham area due to the rough terrain, heavy vegetation and lack of roads for circuit routes between the station and the Bingham service area. However, an additional circuit from Jingo is included in one of the scenarios presented in this document, due to the lack of alternate acceptable circuit routes from our other stations.

Any dollars in the original April 1999 study associated with capacity increases at Henpeck and Grassland will still be needed in the future. The dollars will need to be inflated and placed into the new study in the correct year as shown in the above discussion.

#### DEVELOPMENT DRIVERS

The extension of Mack Hatcher Parkway has been discussed for several years. The general route of this major highway has now been selected, and the opening of this new road will open up large areas to development along its length. The road will also provide access to Franklin from the existing road system west of Franklin.

The most significant event that will drive the ultimate build out of the area west of Franklin is the extension of the sewer system. This will greatly increase the attractiveness of the area to developers because of the increased densities possible with sewer service.

As an example of the type of developments expected in the Bingham service area, consider Westhaven. This is a development projected to be on the scale of Fieldstone Farms, which has a peak demand of 20 MW. This development is approved and will soon be under

construction. There are hundreds of acres of land in the area that will be highly developable once sewer service is made available.

As the area develops, additions to the infrastructures-roads, sewer, water, etc. are expected or already underway. The electric system infrastructure likewise will require significant additions.

Based on the above drivers that have developed since the April 1999 study, we have modified the ultimate loading on the Bingham Station. The table below shows loading for various scenarios on a MW per square mile basis.

|                   | Load in MW | Square Miles | MW per SQ. MI | Notes |
|-------------------|------------|--------------|---------------|-------|
| MTEMC             | 922        | 2000         | .461          |       |
| Williamson County | 385        | 584          | .659          |       |
| Aspen Grove       | 60         | 13.4         | 4.478         |       |
| Grassland         | 32         | 55.5         | .577          |       |
| Jingo             | 26         | 133          | .195          |       |
| Cannon County     | 24         | 266          | .090          |       |
| Bingham Today     | 10.5       | 107.6        | .098          |       |
| Bingham Future    | 21         | 107.6        | .195          | 1     |
| Bingham Future    | 62         | 107.6        | .577          | 2     |
| Bingham Future    | 482        | 107.6        | 4.478         | 3     |
| Bingham Future    | 84         | 107.6        | .7761         | 4     |

- Notes

1. Bingham area loading assuming ultimate Jingo type development
2. Bingham area loading assuming ultimate Grassland type development
3. Bingham area loading assuming ultimate Aspen Grove type development
4. Bingham area loading assuming ultimate 10% Aspen Grove, 40% Grassland and 50% Jingo type development

While ultimate loading for the Bingham Station service area can not be determined with certainty, a comparison of the Bingham service area with the other areas of Williamson County yields some reasonable results. The area likely will not develop at the level of the Aspen Grove Station. At the other extreme, it will also likely not develop at the level of the Jingo Station. Different portions of this 107.6 square mile area will develop differently. The selection of a 10% Aspen Grove, 40% Grassland and 50% Jingo level of loading appears to be reasonable. This yields an ultimate loading in the Bingham Substation area of 84 megawatts. Different mixtures of loading can be applied, but any reasonable selections will not make the statements in the following paragraph untrue.

#### Aspen Grove - Westhaven 161-kV Transmission Line

This amount of load can not be reliably or economically transmitted to the Bingham service area from any of MTEMC's existing substations. 84 megawatts is also a level of load that can not be served from one new station. This fact supports our thinking that a future station between Aspen Grove and Bingham will be needed.

### OUTAGE RATES

Along with the capacity concerns, there are also serious reliability concerns in this area. The feeder distances into the western part of the county are long, and much of the terrain is not conducive to easy maintenance of our facilities.

The three circuits serving this area have had more power interruptions than the average for the rest of our system. This is largely due to the length of the lines, the heavy vegetation and the terrain. For our entire system, the average number of minutes a typical customer experiences in a year has been 112 for the past five years, but has only been slightly above 70 minutes for the past two years. The numbers for the western part of Williamson County have been 145 minutes over the past five years, or approximately 30% higher than the system average.

The addition of the substation at Bingham would greatly reduce the outage times for customers in this area. It is expected that the outage rate would be somewhat less than our system average, due to the fact that the majority of customers served from this station will be much closer-in than they now are to the stations that serve them. Without the station, additional long feeders would have to be constructed from our existing stations. This fact, coupled with the fact that reliability decreases as loading increases, make it likely that this area will not see any improvements in outage time if Bingham is not built.

Outage and loading data for various scenarios are presented in the following charts:

| Circuit | Present Loading (MW)                                   | Average Outage Rate |
|---------|--|---------------------|
| JIN 224 | <ul style="list-style-type: none"><li>• 4.6</li></ul>  | 1.29 Hours          |
| HEN 254 | <ul style="list-style-type: none"><li>• 13.2</li></ul> | 3.31 Hours          |
| GRA 264 | <ul style="list-style-type: none"><li>• 7.2</li></ul>  | 1.54 Hours          |

## Projections if Bingham is built:

| Circuit | Init. Load | Ult. Load | Init. Outages | Ult. Outages |
|---------|------------|-----------|---------------|--------------|
| BIN 1   | • 3.3 MW   | 17.5 MW   | 1.0 Hours     | 1.0 Hours    |
| BIN 2   | • 2.0 MW   | 17.5 MW   | 1.0 Hours     | 1.0 Hours    |
| BIN 3   | • 5.2 MW   | 17.5 MW   | 1.0 Hours     | 1.0 Hours    |
| BIN 4   | 0          | 17.5 MW   | 1.0 Hours     | 1.0 Hours    |

Ultimate loading of 70 MW on a substation was discussed earlier in this document. The station would initially contain 3 breakers, but additional breakers would be added as the loading increases. The additional breakers will reduce loading on the remaining circuits, which should keep the outage numbers from rising much, if at all. With a projected ultimate loading in the Bingham area of 84 MW, a future station between Bingham and Aspen Grove is projected to be needed in the future to serve the additional load.

## Projections if Bingham is not built:

| Circuit   | Init. Load | Ult. Load | Init. Outages | Ult. Outages |
|-----------|------------|-----------|---------------|--------------|
| JIN New   | • 5.0 MW   | 16.8 MW   | 1.29 Hours    | 1.50 Hours   |
| HEN New   | • 3.0 MW   | 16.8 MW   | 3.31 Hours    | 3.75 Hours   |
| HEN New 2 | 0          | 16.8 MW   | 3.31 Hours    | 3.75 Hours   |
| GRA New   | 3.9 MW     | 16.8 MW   | 1.54 Hours    | 1.75 Hours   |
| GRA New 2 | 0          | 16.8 MW   | 1.54 Hours    | 1.75 hours   |

Ultimate loading of 84 MW KW will require at least 5 new circuits, since without Bingham in service, there will also be no transmission available to serve the future station between Bingham and Aspen Grove.

These 5 circuits will be very difficult to construct, as existing roadways into the Bingham area are already used as circuit routes. Double and triple circuits along roadways are terrible from a reliability standpoint. I doubt we can find five “new” routes, and therefore will be forced into construction of multiple circuits along existing routes, which will negatively impact our outage rates.

The construction work shown under Option 2 in the original information provided by MTEMC to TVA will still be needed if Bingham is not constructed. However, the original study projected only three circuits needed to serve an ultimate loading of approximately 60 MW. Loading is now projected to be 84 MW, which will necessitate 2 additional circuits if Bingham is not built. Additional breakers and circuit costs will need to be included in the new analysis.

#### Aspen Grove - Westhaven 161-kV Transmission Line

The second new HEN circuit is projected to be needed in 2011. This will require a breaker and a distribution bay. Along with the associated circuit costs, a total of \$681,339 will be needed.

Grassland Station will require a third bank in 2009, with associated circuit bays, switchers, breakers and circuit work. The cost in 2009 dollars is estimated to be \$4,825,951.